

Claims

1. (Withdrawn) A magnetic nanoparticle having a core of metal atoms, wherein the core is covalently linked to a plurality of ligands and has a diameter of less than 2.5nm.
2. (Withdrawn) The magnetic nanoparticle of claim 1, wherein the core comprises passive metal atoms and magnetic metal atoms.
3. (Withdrawn) The magnetic nanoparticle of claim 1, wherein the core comprises passive metal atoms.
4. (Withdrawn) The magnetic nanoparticle of claim 2, wherein the passive metal is gold, platinum, silver or copper and the optional magnetic metal is iron, cobalt or gadolinium.
5. (Withdrawn) The magnetic nanoparticle of claim 1, wherein the core is formed from atoms of Au, Au/Fe, Au/Cu, Au/Gd, Au/Fe/Cu, Au/Fe/Gd or Au/Fe/Cu/Gd.
6. (Withdrawn) The magnetic nanoparticle of claim 2, wherein the ratio of passive metal atoms to magnetic metal atoms in the core is between about 5:0 and about 2:5
7. (Withdrawn) The magnetic nanoparticle of claim 2, wherein the ratio of passive metal atoms to magnetic metal atoms in the core is between about 5:0.1 and about 5:1.
8. (Withdrawn) The magnetic nanoparticle of claim 2, wherein the passive metal is gold and the magnetic metal is iron.
9. (Withdrawn) The magnetic nanoparticle of claim 8, wherein the ratio of gold atoms to iron atoms is about 5:0.1.
10. (Withdrawn) The magnetic nanoparticle of claim 8, wherein the ratio of gold atoms to iron atoms is about 5:1.

11. (Withdrawn) The magnetic nanoparticle of claim 1, wherein the core has a diameter of less than 2.0 nm when the core contains only passive metal atoms such as Au.
12. (Withdrawn) The magnetic nanoparticle of claim 1, wherein said ligands incorporate a lanthanide.
13. (Withdrawn) The magnetic nanoparticle of claim 12, wherein the lanthanide is gadolinium.
14. (Withdrawn) The magnetic nanoparticle of claim 1, wherein the nanoparticle comprises an NMR active atom.
15. (Withdrawn) The magnetic nanoparticle of claim 14, wherein the NMR active atom is Mn^{+2} , Gd^{+3} , Eu^{+2} , Cu^{+2} , V^{+2} , Co^{+2} , Ni^{+2} , Fe^{+2} , Fe^{+3} or a lanthanide⁺³.
16. (Withdrawn) The nanoparticle of claim 1, wherein the ligand comprises a carbohydrate group.
17. (Withdrawn) The nanoparticle of claim 1, wherein said ligands comprise a polysaccharide, an oligosaccharide or a monosaccharide group.
18. (Withdrawn) The nanoparticle of claim 1, wherein said ligands comprise a glycanoconjugate.
19. (Withdrawn) The nanoparticle of claim 18, wherein the glycanoconjugate is a glycolipid or a glycoprotein.
20. (Withdrawn) The nanoparticle of claim 1, wherein said ligands are linked to the core via a sulphide group.

21. (Withdrawn) The nanoparticle of claim 1, wherein the nanoparticle comprises a label.
22. (Withdrawn) The nanoparticle of claim 21, wherein the label is a fluorescent group or a radioactive isotope or a NMR active atom.
23. (Withdrawn) The nanoparticle of claim 1, wherein the nanoparticle comprises a peptide.
24. (Withdrawn) The nanoparticle of claim 1, wherein the nanoparticle comprises DNA or RNA.
25. (Withdrawn) The nanoparticle of claim 1, wherein the nanoparticle comprises a pharmaceutically active component.
26. (Withdrawn) The nanoparticle of claim 1, wherein the ligand is capable of binding a receptor on a cell.
27. (Withdrawn) The nanoparticle of claim 1, wherein the nanoparticle is water soluble.
28. (Withdrawn) A composition comprising a population of at least one of the nanoparticles of claim 1.
29. (Withdrawn) The composition of claim 28 which comprises a plurality of nanoparticles having different ligand groups.
30. (Canceled)
31. (Withdrawn) The composition of claim 28 in the form of a colloid.
32. (Withdrawn) The composition of claim 31, wherein the nanoparticles of said colloid have a mean diameter of less than 2nm.

33. (Withdrawn) The composition of claim 31, said colloid being stable for at least about 1 year.

34.-51. (Canceled)

52. (Withdrawn) A method of preparing nanoparticles according to claim 1, wherein the nanoparticles comprise a core comprising gold atoms and optionally iron atoms, said core being covalently linked to a plurality of ligands, the method comprising:

(a) synthesizing a sulphide derivative of the ligand; and

(b) reacting the sulphide derivatised ligand with HAuCl₄ (tetrachloroauric acid), and optionally with a ferric salt where iron atoms are present in the core, in the presence of reducing agent to produce the particles.

53. (Withdrawn) The method of claim 52, wherein step (b) comprises derivatising the ligand with a linker.

54. (Withdrawn) The method of claim 53, wherein the the linker is a disulphide linker.

55. (Withdrawn) The method of claim 54, wherein the disulphide linker group is represented by the general formula HO-(CH₂)_n-S-S-(CH₂)_m-OH, wherein n and m are independently integers between 1 and 5.

56. (Withdrawn) The method of claim 55, wherein the ligand is derivatised as a protected disulphide.

57. (Withdrawn) The method of claim 52, wherein the ligand comprises a carbohydrate group.

58. (Withdrawn) A nanoparticle produced by the method of claim 52.

59. (Withdrawn) A method of disrupting an interaction between a carbohydrate and a binding

partner, the method comprising contacting the carbohydrate and the binding partner with nanoparticles according to claim 1, wherein the ligands bound to the nanoparticles comprise a carbohydrate group capable of disrupting the interaction of the carbohydrate and the binding partner.

60. (Withdrawn) A method of screening for substances capable of binding to a ligand, the method comprising (a) contacting the nanoparticles of claim 1 with one or more candidate compounds and (b) determining whether the candidate compounds binds to the ligand.

61. (Withdrawn) A method of determining the presence in a sample of a substance capable of binding to a ligand, the method comprising (a) contacting the sample with the nanoparticles of claim 1 so that the substance binds to the ligand of the nanoparticles and (b) determining whether binding takes place.

62. (Withdrawn) The method of claim 61, further comprising the step of correlating the presence or absence of binding with the diagnosis of a disease state associated with the presence of the substance.

63. (Withdrawn) The method of claim 61, wherein the substance is an antibody which is capable of binding to the ligand.

64. (Withdrawn) A method of determining whether a carbohydrate mediated interaction occurs, the method comprising (a) contacting one or more species suspected to interact via a carbohydrate mediated interaction with the nanoparticles of claim 1 and (b) determining whether the nanoparticles modulate the carbohydrate mediated interaction.

65. (Withdrawn) The method of claim 59, wherein the nanoparticles are detected by nuclear magnetic resonance (NMR), aggregation, transmission electron microscopy (TEM), atomic force microscopy (AFM), surface plasmon resonance (SPR), or with nanoparticles comprising silver atoms, signal amplification using the nanoparticle-promoted reduction of silver (I).

66. (Withdrawn) A method for vaccination of a patient with an antigen, said method comprising administering to said patient a vaccine comprising nanoparticles according to claim 1, wherein the ligands linked to the core of the nanoparticle comprise said antigen.

67. (Withdrawn) The vaccination according to claim 66, wherein the vaccine is administered by application of a magnetic field.

68. (Withdrawn) A method for vaccination of a patient with a nucleic acid encoding an antigen, said method comprising administering to said patient a vaccine comprising nanoparticle according to claim 1, wherein the ligand linked to the core of the nanoparticle comprise said nucleic acid.

69. (Withdrawn) The vaccination method according to claim 68, wherein the vaccine is administered by application of a magnetic field.

70. (Currently Amended) A method for performing magnetic resonance imaging (MRI) of a site in a patient, said method comprising administering to said patient a MRI contrast agent comprising nanoparticles, said nanoparticles having a core of metal atoms, wherein the core is covalently linked to a plurality of ligands and has a diameter of less than 2.5 nm, and wherein said ligands incorporate or chelate a lanthanide.

71. (Previously presented) The method of claim 70, wherein the imaged site comprises the lungs of said patient.

72. (Previously presented) The method of claim 70, wherein the nanoparticles comprise gadolinium and have a core diameter of less than 1.0 nm.

73. (Withdrawn) A method for treating cancer in a patient, said method comprising administering to said patient a medicament comprising nanoparticles according to claim 1.

74. (Withdrawn) The method of claim 73, wherein said cancer is a tumor.

75. (Withdrawn) The method of claim 73, wherein said tumor is exposed to a high frequency magnetic field or said tumor is exposed to infrared light.

76. (Withdrawn) The method of claim 73, wherein said nanoparticles comprise a ligand which is a tumor-associated antigen or tumor autocrine factor.

77. (Withdrawn) The method of claim 76, wherein said ligand is a carbohydrate.

78. (Withdrawn) A method for inhibiting tumor metastasis in a patient, said method comprising administering to said patient a medicament comprising nanoparticles according to claim 1.

79. (Withdrawn) The method of claim 78, wherein the ligands comprise a carbohydrate with specificity or affinity for metastasis, a hormone, or DHEA, a peptide capable of binding to a cell-specific receptor, a lipid for binding a toll receptor, methylene blue for binding to metastasising melanoma cells.

80. (Withdrawn) A method of performing myocardial salvage on a patient, said method comprising administering to said patient a medicament comprising nanoparticles according to claim 1.